

DRAFT

TOTAL MAXIMUM DAILY
LOAD (TMDL) DEVELOPMENT

for

BROOKS RUN

(FLOYDS FORK BASIN, BULLITT COUNTY, KENTUCKY)



Natural Resources and
Environmental Protection Cabinet

Kentucky Division of Water

December 2001

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for

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**KENTUCKY DEPARTMENT FOR ENVIRONMENTAL PROTECTION
DIVISION OF WATER**

Frankfort, Kentucky

This report has been approved for release:

Jeffrey W. Pratt, Director
Division of Water

Date

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TMDL FACT SHEET

BROOKS RUN

Project Name: Brooks Run: Organic Enrichment/Low DO/Pathogens/Nutrients

Location: Floyds Fork Basin, Bullitt County, Kentucky

Scope/Size: Brooks Run: River mile 0.0 to 6.1

TMDL Issues: Point Sources

Data Sources: Kentucky Department for Environmental Protection
Division of Water

Control Measures: KPDES Regulations

Water Quality Standard/Target: Maintain Dissolved Oxygen (DO) concentration greater than 5.0 milligrams per liter (mg/l). Maintain un-ionized Ammonia concentrations less than 0.05 mg/l, which translates to 4 mg/l total Ammonia under design conditions of pH (7.2 units) and temperature (25°C). Reduce Phosphorus concentrations to avoid nuisance algal blooms. Reduce Pathogens to meet criteria, which are: Fecal Coliform content shall not exceed 200 colonies per 100 ml as a monthly geometric mean based on not less than five (5) samples per month; nor exceed 400 colonies per 100 ml in twenty (20) percent or more of all samples taken during the month. These limits shall be applicable during the recreation season of May 1 through October 31. These standards are found within Regulation 401 KAR 5:031.

Summary:

Brooks Run was determined as not supporting the designated use of aquatic life and contact recreation. Therefore, the stream was listed on the 303(d) list for Total Maximum Daily Load (TMDL) development. Brooks Run and several of its tributaries are impacted by organic enrichment, low DO, and Pathogens. Nutrients (Phosphorus) are also elevated, but not noted on the 303(d) list. The critical conditions are low stream flow and warm summertime conditions. The primary causes for these problems are the discharges from the privately owned wastewater treatment plants (WWTPs) located throughout the basin. Several of these have had, and continue to have, severe KPDES permit violations. The Kentucky Division of Water (KDOW) has undertaken a number of steps to rectify these conditions.

TMDL Development: Total Maximum Daily Loads, in pounds per day (lbs/day), are computed based on the allowable maximum concentration for Carbonaceous Biochemical Oxygen Demand (CBOD), Nitrogen Ammonia (NH₃-N), and Total Phosphorus (TP) during the critical low-flow period. An effluent "load" for Fecal Coliform bacteria (FC) is also determined, in units of colonies per day. These parameters were chosen for TMDL development because they are the pollutants of concern for these stream segments. The calculations are based upon the replacement of all the existing WWTPs with a regional facility (or facilities) with a total design flow of 3.5 million gallons per day (mgd), to be owned and operated by the Bullitt County Sanitation District.

Summary of Total Maximum Daily Load Allocations

<u>Source:</u>	<u>CBOD</u>	<u>NH3-N</u>	<u>FC</u>	<u>TP</u>
All Sources	292	58.4	52,990 E6	29.2
Background	0	0	0	0
Waste Load Allocations (WLAs)	292	58.4	26,495 E6	29.2

Background loads are zero based on the critical low-flow conditions of these streams, which are dry during hot, summertime conditions. Permitted discharge loads were calculated using EPA-approved water-quality modeling procedures and regulatory water-quality standards. The loadings are based on a simple conversion of discharge permit concentrations multiplied by the WWTP size (mgd). Thus, if regional WWTPs are in need of expansion, the model runs and effluent limits will be revisited. An increase in loading could be approved. Total maximum daily loads of Fecal Coliform (FC) in colonies per day were computed based on the allowable maximum FC value, of 400 colonies per 100 milliliters of sample in no more than 20 percent of samples during routine (monthly) sampling. For point source dischargers, the FC count shall not exceed 200 colonies/100 ml of sample as a monthly average and shall not exceed 400 colonies per 100 milliliters of sample as a maximum of all samples taken during the month.

The dischargers are required to submit Discharge Monitoring Reports (DMRs) to the KDOW which includes a reporting of the monthly mean and the maximum FC determination of the effluent. The Waste Load Allocation (WLA) value is based on an FC count of 200 colonies/100 ml of sample.

Existing Loads and Load Reductions:

	Existing*	TMDL	Reduction
CBOD:	186 lbs/day	292	None**
NH3:	40.4 lbs/day	58.4	None**
Total P:	33.3 lbs/day	29.2	4.1 lbs/day
FC:	83,125 E6 col/day	26,495 E6	56,630 E6 col/day

* Existing loads are based upon the sum of the permitted loads from the existing WWTPs. The Fecal Coliform load is based upon the sum of loads of the FC violations measured on the August 1999 sampling trip.

** Concentrations (mg/l) will be reduced; however, the load is greater because the flow of the regional facility to serve the needs of northern Bullitt County is larger than the combined flows of existing WWTPs in Brooks Run. Total loading to the environment will likely be reduced because the regional facility will serve areas currently on poorly operating septic tank systems, plus eliminate several privately owned WWTPs in an adjacent stream basin.

Implementation Controls: Efforts have been underway since 1990 to improve conditions in Brooks Run. The KDOW has promoted the formation of a countywide sanitation district to provide a regional system to serve the wastewater treatment needs of northern Bullitt County. A sanitation district was formed in 1997 but received essentially no funding until 2000.

The district is currently in negotiations to purchase a number of the existing WWTPs. The next step will be the completion of a 201 Plan for determining the best method of providing regional sewer service to the area.

Because of the water quality problems in the area, the KDOW has denied six (6) requests for new or expanded privately owned WWTPs in the Brooks Run basin, as well as six (6) additional requests in adjacent stream basins over the past several years. Tap-on bans and enforcement actions have been applied to some of the existing WWTPs. The solution for improving water quality in this rapidly growing area is a regional system to properly collect and treat wastewater.

TMDL DEVELOPMENT

Brooks Run Floyds Fork Basin, Bullitt County, Kentucky

Introduction

Section 303(d) of the Clean Water Act and the Environmental Protection Agency's (EPA) Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for water bodies that are not meeting designated uses under technology-based controls for pollution. The TMDL process establishes the allowable loadings of pollutants or other quantifiable parameters for a water body based on the relation between pollution sources and in-stream water quality conditions. States can then establish water-quality based controls to reduce pollution from both point and nonpoint sources and restore the quality of their water resources.

Problem Definition

Brooks Run lies entirely within a rapidly growing area of northern Bullitt County. The stream, from its mouth to a point near its headwaters (a distance of 6.1 miles), was first listed in Kentucky's 1990 303(d) list of impaired waters. The stream fails to support its designated uses of Warm Water Aquatic Habitat and Primary and Secondary Contact Recreation because of organic enrichment, low Dissolved Oxygen (DO), and Pathogens. Although not specifically listed, nutrients (Phosphorus) are also of concern. The primary sources of the problems are the numerous privately owned package wastewater treatment plants (WWTPs) located throughout the area. The Kentucky Division of Water (KDOW) continued to list the stream as not supporting in the 1992, 1994, 1996, and 1998 303(d) reports. Prior to the 1990 listing, in 1988 the stream was found to violate the Fecal Coliform (the indicator for Pathogens) standard, and based on this, a local church ended its practice of conducting baptisms in a pool of Brooks Run. Several unnamed tributaries to Brooks Run are also

impaired, and this report applies to these streams as well. Many of the WWTPs are located on these unnamed tributaries.

Efforts to improve these conditions by the KDOW also date back to 1990. Through letters and meetings with Bullitt County officials, the KDOW began promoting the creation of a regional wastewater treatment authority (sanitation district) to provide centralized wastewater treatment service for this area of northern Bullitt County. The KDOW began denying construction of new privately owned plants in the area. Expansion of existing facilities was tied to compliance history of the facility and other factors, such as specific location and existing permit limits. Some expansions were allowed if limits could be reduced such that there was a net improvement to water quality. Enforcement actions have also been undertaken against facilities in significant noncompliance. Facilities have been required to clean sludge from the creeks below their outfalls. Because of continuing water quality problems and lack of progress on implementing a regional solution, the KDOW began denying all requests for expansions in the mid 1990s. Six (6) requests for new or expanded facilities have been denied in the Brooks Run basin, and another six (6) were denied in nearby streams that are also within the rapidly growing northern Bullitt County area. All of these streams flow into Floyds Fork, which was the subject of a previous TMDL report. Appendix I includes a number of letters and a newspaper article that further describe the difficulties encountered in the attempt to provide centralized sewer service for this area.

In April 1997, Bullitt County formed a sanitation district. Three (3) local individuals agreed to serve as commissioners. A local engineering firm has been providing services for the district. Although essentially unfunded, without offices or staff, the district began looking into the wastewater treatment needs of the area. Through local agreements, a new WWTP is planned on Brooks Run at a major interchange of I-65 and Brooks Run Road. This facility will be publicly owned and operated, serve a major new industrial customer, and eliminate two (2) existing package plants. In addition, negotiations between the district and private owners are underway for the district to take ownership and operation of the existing treatment

plants. In 2000, Bullitt County received a community development grant through the regular session of the Kentucky General Assembly in the amount of \$2 million. This funding was to be divided countywide among competing water and sewer projects, with a portion set aside for the Brooks Run area. Water quality conditions in Brooks Run are not likely to significantly improve until such time as the district is successful in acquiring and ultimately eliminating the package WWTPs through construction of a regional facility. The purpose of this TMDL report is to further describe these problems and determine effluent limits and possible loading values needed to restore water quality to meet state standards.

Description of Study Area

Brooks Run flows about seven (7) miles in a southerly direction from its headwaters along the Bullitt and Jefferson County line to its mouth. The stream empties into Floyds Fork at mile 3.7 (Figure 1). The drainage area of Brooks Run, at its confluence with Floyds Fork, is about ten (10) square miles. Stream slopes are fairly steep, and water moves quickly through the system. Pools, however, do exist along various reaches of the stream. Several unnamed tributaries (UT) drain into Brooks Run along its length, and much of the area is urbanized. Rapid growth and development are occurring throughout this area of northern Bullitt County. The corridor along I-65, a major north-south interstate, is developed with commercial and light industrial activities, and the demand for additional growth is high. Much of this growth has been delayed by the lack of adequate wastewater treatment capacity. The small towns of Hillview and Pioneer Village are located within the northern portion of the Brooks Run basin along unnamed tributaries and are currently served by privately owned WWTPs. The lower two (2) miles of Brooks Run is fairly rugged and mostly undeveloped. The most recent assessments indicate that Brooks Run from river mile 0.0 to 2.5 fully supports aquatic life and swimming uses, but is categorized as "threatened."

Floyds Fork has been the subject of a previous TMDL report, largely because of problems caused by privately owned package WWTPs located throughout the basin. Floyds Fork begins in Oldham County and flows 67 miles through Oldham, Jefferson, and Bullitt counties.

Drainage from Brooks Run and the adjacent Tanyard Branch flows into Floyds Fork in this growing area of northern Bullitt County. In 1991, there were 70 WWTPs located throughout the basin, sixteen (16) of them in this area of Bullitt County. The TMDL for Floyds Fork called for the elimination of many of these WWTPs by construction of regional wastewater treatment facilities. Regional systems have been constructed in both Oldham and Jefferson counties, and 22 package plants have been eliminated to date, with projects under construction to continue this progress. As mentioned previously, Bullitt County is in the early planning phase of similar projects.

Figure 1: Brooks Run Basin, Bullitt County, Kentucky,
and Sampling Stations

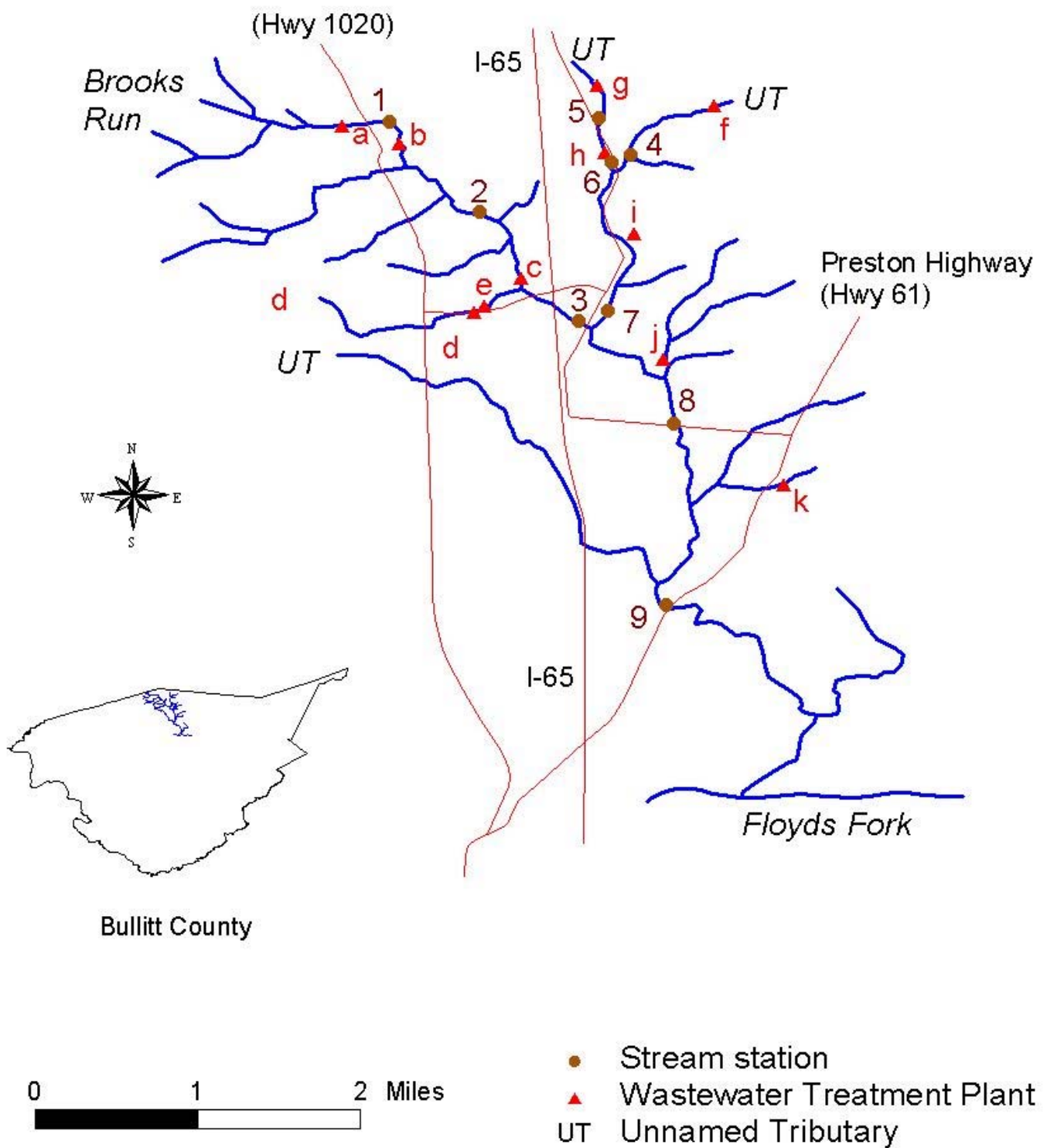


Table 1.
List of Stream Sampling Stations

Map #	Description
1	Brooks Run at mile 5.7, bridge on Sarva Road
2	Brooks Run at mile 5.0, ford on Sarva Road
3	Brooks Run at mile 4.1, below bridge on Highway 1450
4	Unnamed tributary at mile 0.05, downstream of Hillview #2 WWTP
5	Unnamed tributary above Hunters Hollow WWTP
6	Unnamed tributary below Hunters Hollow WWTP
7	Unnamed tributary at mile 0.1, just above confluence with Brooks Run
8	Brooks Run at mile 3.2, at bridge on Hebron Lane (Hwy 1450)
9	Brooks Run at mile 1.9, at culvert on Highway 61

Table 2.
List of Wastewater Treatment Plants

Map #	Facility Name	KPDES #	Design flow (mgd)*
a	L&N Golf Course	KY0077666	0.005
b	Country Living Mobile Home Park	KY0102873	0.015
c	Willabrook	KY0094307	0.12
d	Brooks Elementary School	KY0100994	0.01
e	Pilot Travel Center	KY0096288	0.0175
f	Hillview #2	KY0034169	0.32
g	Whispering Oaks Mobile Home Park	KY0023078	0.125
h	Hunters Hollow	KY0038610	0.24
i	Hillview #3	KY0034177	0.148
j	Pioneer Village	KY0034185	0.31
k	Hebron Middle/High School	KY0100994	0.02

* mgd - million gallons per day

Wastewater Treatment Plants

Throughout the 1960s, 1970s, and midway through the 1980s, development utilizing privately owned package wastewater treatment plants was a common practice, both on a national and statewide basis. In the mid to late 1980s, the KDOW became increasingly more aware and concerned about the problems caused by these facilities. Data compiled from self-monitoring reports required of all point source dischargers, as well as field inspections of permitted facilities and water quality studies, supported anecdotal evidence that private package plants, on the whole, do not perform as well as their municipally owned counterparts (KDOW, 1994). Treatment plant size also has an impact on efficiency: "Small randomly placed wastewater treatment plants can be inefficient in terms of reliability. Studies indicate that there is a high correlation between the size of a treatment plant and the percentage of time during which the plant fails to perform according to design standards. In short, the larger the treatment plant, the more reliable is its performance." (*Water Pollution Control Legislation: Hearings Before the Subcommittee on Air and Water Pollution of the Committee on Public Works*, United States Senate 92d. Congress, Washington, D.C. United States Government Printing Office, May 1971, p. 923).

In order to address these problems, the KDOW began focusing on the concept of regionalization in the early 1990s. This is defined as:

- 1) the elimination of a treatment facility and diversion of its wastewater flow to a publicly owned treatment works (POTW);
- 2) the connection of one (1) or more existing facilities into a new or existing regional facility;
- 3) the prevention of new discharges by requiring connection to an existing facility; or
- 4) the creation of sanitation districts, regional wastewater authorities, or other cooperative ownership arrangements.

Projects have been, and continue to be, undertaken statewide to eliminate as much as possible privately owned WWTPs. Projects in Boyd, Daviess, Oldham, Jefferson, Fayette, and other counties have eliminated large numbers of package plants located in close proximity to each other.

There are eleven (11) WWTPs located in the Brooks Run basin (Table 2). Two (2) are owned by the local school board, with the remainder privately owned. These range in size from the 5000-gallon per day (gpd) facility serving the L&N Golf Course to the 320,000 gpd Hillview #2 facility. Most are located within just a few miles of each other. As noted above, privately owned WWTPs have been an environmental problem in Kentucky for many years, and northern Bullitt County has not escaped these problems. Water quality has been impacted by the failure of these facilities to consistently meet permit limits. This is discussed in more detail in the next section of this report. Various enforcement actions have been undertaken to bring these facilities into compliance, including formal Notices of Violation resulting in legal action and fines, sewer tap-on bans (allowing no new connections to a facility), and requiring owners to clean sludge deposits out of streams. More recent action has been to require a Sanitary Sewer Overflow Plan from those facilities suspected of having these problems, as evidenced by sludge deposits in the stream, aging infrastructure, or previous history of overflow problems. Some of these problems relate to the general inefficiency and age of these package plants, while others are caused by poor operation and maintenance practices. Water quality in this area of northern Bullitt County is not likely to fully meet state standards until a regional system is available and the existing plants are eliminated.

Water Quality Conditions

From August 3 through 5, 1999, KDOW staff conducted a water quality sampling trip in the Brooks Run Basin (Table 3). Streamflow was fairly low and stable during this period, increasing somewhat in a downstream direction as drainage area increased. Weather conditions had been stable and dry for a week prior to sampling. Monthly samples were also collected at Station 9 from April 1999 through January 2000, representing a range of flow and weather conditions (Table 4). The most serious problems noted during the August trip were the Fecal Coliform violations found both in-stream and from some of the WWTPs. Note the 1500 colonies/100 mls measured at Station 2. At the time of this sampling trip, the Country Living Mobile Home Park, upstream of Station 2, was using a septic tank and leach field system for wastewater disposal.

Table 3
Water Quality Data in Brooks Run Basin, August 1999

Map # *	Date	Time	Flow (cfs)	Dissolved Oxygen (mg/l)	pH (Units)	Water Temperature (Deg. C.)	Specific Conductance (umhos)	Fecal Coliform (col/100 mls)	CBOD (mg/l)	Total Suspended Solids (mg/l)	Ammonia (mg/l)	Total Phosphorus (mg/l)
1	8/3/99	8:20	0.20	5.4	7.5	25.0	1250	<10				
2	8/3/99	8:40		5.3	7.6	20.8	1230	1500				
c	8/3/99	9:00	0.07	7.8	7.4	26.2	810	<10				
	8/4/99	9:55		7.5	7.6	25.8	830					
d	8/3/99	9:45	<.001	6.7	7.4	23.4	744	220				
e	8/3/99	9:50	<.001	8.0	7.9	21.6	600	<10				
3	8/3/99	10:00	0.17	7.3	7.7	22.1	917	500				
	8/4/99	7:25		5.3	7.6	20.9	854		1.0	1	<.05	1.91
	8/4/99	9:00		6.1	7.6	21.2	862					
	8/5/99	8:05		5.6	7.6	21.3	842					
f	8/3/99	11:15	0.16	6.4	6.6	27.8	852	<10				
4	8/3/99	11:45		5.5	6.9	22.8	890	520				
	8/4/99	8:00		3.2	6.9	21.7	897					
	8/5/99	7:30		3.3	6.9	22.6	856					
g	8/3/99	10:45	0.14	7.1	7.3	24.4	794	3000				
5	8/4/99	8:15		4.7	7.3	21.3	779					
h	8/3/99	12:15	0.23	7.7	7.3	26.8	660	6800				
	8/4/99	8:30		7.6	7.4	26.5	670					
6	8/3/99	12:30						3000				
	8/4/99	8:05		4.1	7.1	24.4	750					
	8/5/99	7:35		4.2	7.1	24.2	762					

Table 3

Map # *	Date	Time	Flow (cfs)	Dissolved Oxygen (mg/l)	pH (Units)	Water Temperature (Deg. C.)	Specific Conductance (umhos)	Fecal Coliform (col/100 mls)	CBOD (mg/l)	Total Suspended Solids (mg/l)	Ammonia (mg/l)	Total Phosphorus (mg/l)
i	8/3/99	12:40	0.07	7.2	7.0	27.6	820	16000				
	8/4/99	12:20		6.8	7.3	26.8	806					
7	8/3/99	13:50	0.36	11.0	7.9	27.2	772	200				
	8/4/99	7:30		5.6	7.4	22.4	805					
	8/4/99	9:30		6.6	7.4	23.1	801		1.0	1	<.05	1.20
	8/5/99	7:45		5.4	7.3	22.7	802					
j	8/3/99	14:30	0.13	6.8	7.0	28.4	745	10				
8	8/3/99	15:00	0.69	9.9	8.2	25.5	768	300				
	8/4/99	7:50		6.4	7.6	21.2	804					
	8/4/99	10:30		7.9	7.8	22.0	796		0.6	1	<.05	1.12
	8/5/99	8:30		6.3	7.6	21.8	801					
9	8/3/99	15:50	0.75	6.8	7.8	23.6	740	310				
	8/4/99	7:40		6.4	7.7	21.0	760		0.9	1	<.05	1.03
	8/4/99	11:30		6.6	7.7	21.7	760					
	8/5/99	8:15		5.7	7.7	21.8	782					

* Numbered sites are stream sampling stations; Lettered sites are wastewater treatment plants.

Table 4
Monthly Data from Station 9

Date	Time	Flow (cfs)	RP*	Dissolved Oxygen (mg/l)	pH (Units)	Water Temperature (Deg. C.)	Specific Conductance (umhos)	Fecal Coliform (col/100 mls)	CBOD (mg/l)	Total Suspended Solids (mg/l)	Ammonia (mg/l)	Total Phosphorus (mg/l)
4/14/99	8:55		13.87	6.6	7.6	11.0	617		0.6	11	<.05	0.37
5/7/99	8:00		13.51	8.4	7.4	14.2	440			12	0.22	0.29
5/25/99								90				
6/9/99	9:00		14.04	5.8	7.6	22.4	630		0.2	10	0.12	0.98
6/21/99								280				
7/8/99								170				
7/15/99	8:45		14.02	5.9	7.7	21.4	849		0.2	2	<.05	0.59
8/3/99	15:50	0.75	14.06	6.8	7.8	23.6	740	310				
8/4/99	7:40			6.4	7.7	21.0	760		0.9	1	<.05	1.03
8/13/99								200				
9/23/99	8:30		14.90	8.6	7.6	12.4	917		0.4	3	<.05	1.55
9/30/99								140				
10/12/99	8:25		13.83	8.4	7.6	14.2	831			3	<.05	0.69
10/28/99								40				
11/23/99	8:55		13.48	4.5	7.5	10.7	843			4	<.05	1.12
12/15/99	8:10		11.92	11.0	7.6	8.1	625		1.2	5	0.14	0.19
1/25/00	9:45		13.70	13.9	7.7	0.1	726		0.2	3	<.05	0.48

* RP - Reference Point-The distance in feet from a mark on the culvert headwall to the surface of the water.

An RP of 14.06 had a streamflow of 0.75 cfs. A larger RP indicates lower stream flow, while a smaller RP is higher flow.

The system was failing, and the Bullitt County Health Department determined that insufficient space was available for this type of system. A WWTP was approved and brought on line for this facility in December 1999. Other Fecal Coliform violations shown on Table 3 appear to be the result of poor operation of several of the WWTPs in the basin. Thick sludge deposits were also found in-stream below the Hunters Hollow, Hillview #2, and Hillview #3 facilities. Sludge loss to a stream is the result of poor design, poor operation and maintenance of both the treatment plant and collection system, or a combination of these factors. Owners of these facilities were notified to remove the sludge deposits from the streams. Dissolved Oxygen was below the state standard of 5 mg/l at stream stations 4, 5, and 6. Total Phosphorous (TP) concentrations were high at all four (4) of the stations sampled for this parameter, ranging from 1.03 mg/l at Station 9 to 1.91 mg/l at Station 3. Total Phosphorus in streams not impacted by wastewater treatment plants in Kentucky is generally less than 0.2 mg/l. Excessive Phosphorus concentrations contribute to noxious growths of algae, which in turn impact the ability of a stream to support a diverse assemblage of aquatic life. There currently is no numerical standard for Phosphorus. This is a subject of intense national research, and criteria will likely be developed in Kentucky during the next water quality standards review in 2003.

Data collected at Station 9 from monthly sampling over a variety of streamflow conditions showed essentially no violations of water quality standards. The low Dissolved Oxygen value (4.5 mg/l) reported on November 23, 1999 may be the result of some unknown water quality problem, but considering the other constituents and water temperature measured that day, it is more likely a measurement error. This site is several miles downstream of the nearest WWTP and is in a rugged area with steep slopes and less development. Phosphorus concentrations, however, remain elevated. It is interesting to note that TP concentration was lowest (0.19 mg/l) during the highest streamflow condition (as determined from a reference point chiseled into the Highway 61 culvert headwall rail) versus the highest value (1.55 mg/l) during the lowest streamflow condition. This is typical of streams with WWTP discharges, which exert their greatest influence on water quality during low-flow conditions.

Follow-up field trips were conducted on December 6, 2000, and May 2, 2001. The purpose was to determine if the sludge deposits noted in August 1999 had been removed from the streams. On December 6, no sludge was observed below the Hunters Hollow facility, yet problems persisted below the two (2) Hillview facilities. On this trip, severe sludge deposits were found to extend below the Pioneer Village facility. Facilities were again notified to remove these deposits. A mechanical problem was reported to be the cause at Pioneer Village. This was subsequently repaired. On May 2, sludge was found only below the two Hillview facilities. The owner of the Hillview facilities has been the subject of enforcement action for several years. A Hearing Officer's Report, filed on September 20, 2000, with the Office of Administrative Hearings, recommended significant financial penalties and a loss of the owner's license to operate wastewater treatment plants in Kentucky. This has been appealed by the defendant to Circuit Court with responses due in the fall of 2001.

Target Identification and TMDL Development

The endpoint, or goal, of the TMDL is to achieve water constituent concentrations (and associated loads in lbs/day) that allow for the sustainability and full support of aquatic life and contact recreation uses in these stream reaches. The critical flow condition is the 7-day, 10-year low flow (7Q10), because it is during low-flow periods that the stream is most susceptible to wastewater effluents. The natural 7Q10 of this relatively small stream is zero cubic feet per second (cfs), as evidenced by U.S. Geological Survey published data (Ruhl and Martin, 1991) from gaging stations on much larger streams in the same geographic area.

As demonstrated in the previous sections of this report, wastewater effluents from the privately owned wastewater treatment plants are the primary sources of stream impairment. The solution is a regional facility (or facilities), owned by the Bullitt County Sanitation District, that allows for the removal of the existing treatment plants, eliminates areas currently served by septic systems,

and allows for growth. The design flow of a facility (or facilities) to provide for these needs is estimated to be 3.5 million gallons per day (mgd).

A TMDL for low-flow conditions is the sum of three (3) basic components: the natural background load, the wasteload allocation (WLA) for point source discharges, and a margin of safety. In this case, the background load is zero because the critical low-flow condition occurs when there is no natural flow in the stream. The WLA establishes effluent limits for CBOD and NH₃-N from a wastewater discharger. These are calculated using well-documented, EPA-approved procedures. These employ the use of a computer model, and Kentucky uses EPA's QUAL2E model for this purpose (Brown and Barnwell, 1987). Maximum values of the pollutants CBOD and NH₃-N are set. These and their corresponding loads for a regional facility are shown on Table 5. The loadings are based on a simple conversion of the QUAL2E model concentration inputs (mg/l) multiplied by the WWTP plant size (mgd). Thus, if WWTPs are in need of expansion, the model runs will be revisited, and an increase in loading (lbs/day) could be approved. The margins of safety for these parameters are implicit because the model itself employs conservative assumptions, including the assumptions that the streamflow is zero (no dilution is available) and water temperatures are warm (77 degrees Fahrenheit). Wastewater effluent has a greater impact upon aquatic life at warm temperatures.

As found from water quality sampling, Phosphorus concentrations are elevated in the Brooks Run basin. Samples collected from a number of municipal dischargers across Kentucky average about 3.0 mg/l. An effluent limit of 1.0 mg/l will be assigned to any new regional facility. This value is commonly being applied to facilities in Kentucky that discharge into nutrient-impacted streams. The corresponding load is shown on Table 5, which is a reduction from the existing loads discharged by the WWTPs in the basin.

Table 5
Effluent Limits and Loadings for a Regional Facility

Facility	Design Flow (mgd)	CBOD Limit (mg/L)	NH3-N Limit (mg/L)	Total Phosphorus (mg/L)	Fecal Coliform (col/100 mls)	CBOD Load (lbs/day)	NH3-N Load (lbs/day)	Total Phosphorus Load (lbs/day)	Fecal Coliform load (col/day)
Regional Facility	3.5	10	2	1	200	292	58.4	29.2	26,495 E6

The endpoint or target of the TMDL is to achieve a Fecal Coliform (FC) count of 400 colonies or less per 100 milliliters of sample (KDOW, 1998a and 1998b). This designated use criteria applies where only periodic samples for FC are collected. For point source permitted to discharge FC (Bullitt County Regional WWTP), the FC count shall not exceed 200 colonies/100 ml of sample as a monthly average, and shall not exceed 400 colonies per 100 milliliters as a maximum of all samples taken during the month. The dischargers are required to submit Discharge Monitoring Reports (DMRs) to the KDOW to assess compliance by the facility. The margin of safety is implicit since the effluent limit is 200 colonies/100 ml versus the criteria of 400 colonies/100 ml. A "load" is calculated by multiplying FC count by the flow amount, arriving at a value with the term "colonies per day." The loads shown in Table 5 are a significant reduction over existing loads (as sampled in August 1999) because there were a number of FC violations at that time. A regional WWTP would eliminate the sources of these violations.

Recommendations

As shown in this report, effluent limits and loads that would be expected to protect water quality in the Brooks Run basin can be calculated. Considering the long history of non-compliance from the privately owned facilities, however, it seems unlikely that these issues will be resolved until such time as a regional facility (or facilities) is built to serve the wastewater needs of this portion of Bullitt County. This process has begun, and will be done incrementally. The Bullitt County Sanitation District will purchase, as funds allow, the existing treatment plants. These would be operated by the district for a period of time, and repairs made as necessary to meet existing permit limits. The district will need to complete a 201 Planning Study, with public review, to determine the future details of providing regional sewer service to this growing area of Bullitt County.

References

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- _____ 1998a. 1998 Kentucky report to Congress on water quality. KY Dept. for Environmental Protection. Kentucky Natural Resources and Environmental Protection Cabinet. Frankfort, KY.
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- Ruhl, K. J. and Martin, G. R. 1991. Low-flow characteristics of Kentucky streams. U.S. Dept. of Interior, Geological Survey, Water-Resources Investigations Report 91-4097.

Appendix I

List of Documents